Fine-scale morphological divergence of wing trait variables in highly fragmented populations of the bog copper butterfly (*Lycaena epixanthe)*

Jessica Jeong[1], ChungYun Christina Kim[1], Lindsay Crawford[1], Nusha Keyghobadi[1]
[1]Department of Biology, Faculty of Science, Western University, London, ON, Canada

Background:

- Habitat fragmentation creates patchy habitat that can lead to small, isolated populations that are more vulnerable to genetic drift and divergence.[1]
- Bog coppers have low mobility and strict habitat needs.[2] We hypothesize that even close-by populations are naturally isolated from each other and have morphologically diverged.
- Studying this species aids in understanding the long-term effects of fragmentation on a species' morphology.[3]

Fig. 1: *Lycaena epixanthe* resting on a plant.

Objective:

- Quantify **variation in butterfly wing traits** (spot and crescents) to measure **morphological divergence** among separate bog populations.

Methods:

- Sampling 9 populations in 2 naturally fragmented bog systems in Algonquin Provincial Park, ON.
- Photos of wings processed using ImageJ and analyzed using R.
- Pilot study to ID most repeatable and variable wing traits for analysis: 7 traits from ventral side.
- Analyses performed separately for each sex to account for sexual dimorphism.

Results:

- The 7 selected traits significantly differ among the 9 bog copper populations, even after accounting for wing length as a covariate.
- Morphological variation doesn't appear to be associated with spatial location i.e., populations in nearby bogs aren't necessarily more morphologically similar.

a) b)

Fig. 2: Male *Lycaena epixanthe* ventral wing samples. Sample a) was obtained from Eos Lake (EOS) while sample b) is from Minor Lake (MIN). Spot 6 is circled in red for comparison between samples and to allow for reference to Fig. 3.

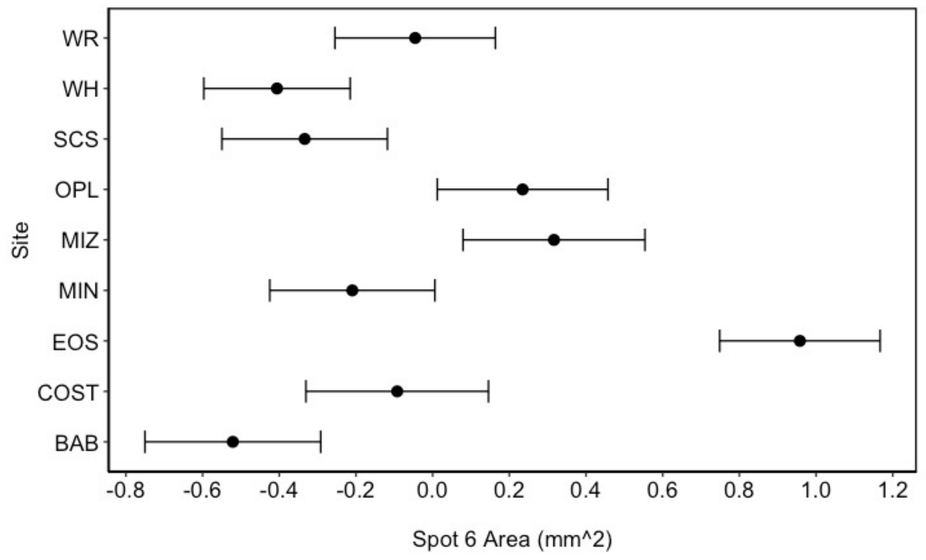

Fig. 3: Mean values (±1SE) for selected wing trait for populations of male *Lycaena epixanthe*. The measurements are scaled and centered around zero to allow for comparison with other traits.

Wing Traits Measured:

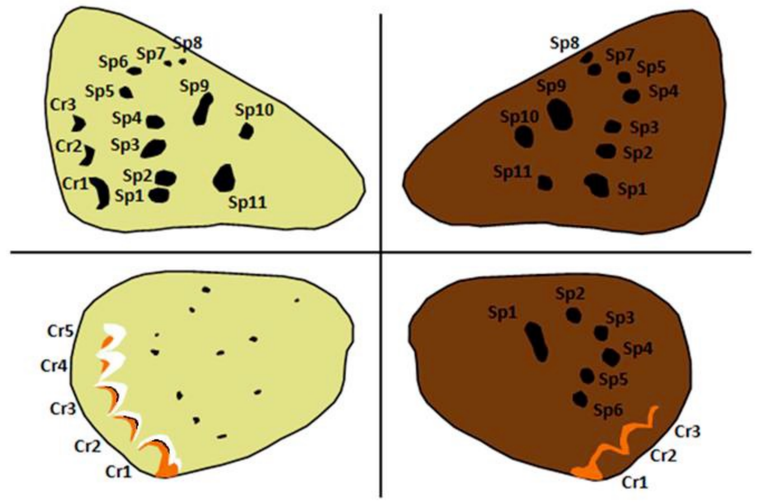

Fig. 4: Schematic of the four wings of a female *Lycaena epixanthe*. Ventral on left, dorsal on right.

Future Direction:

- Compare morphological to genetic variation.
- Observe fluctuating asymmetry in wings as index of fitness or potential inbreeding.
- Compare morphological variation between sexes to quantify effects of sexual dimorphism.
- Examine relation between distance and variation.

Acknowledgements:

Special thanks to the NSERC and USRI program for their support through scholarships and hosting workshops to teach and guide participants.

References:

1. Freeland, J.R., Petersen, S.D. and Kirk, H. 2011. Molecular ecology, ed. 2, John Wiley & Sons, Ltd. Hoboken, USA.
2. Cech, R., and Tudor, G. 2005. Butterflies of the East Coast. An Observer's Guide, Princeton University Press, Princeton, USA.
3. Talloen, W., Van Dongen, S., Van Dyck, H., and Lens, L. 2009. Environmental stress and quantitative genetic variation in butterfly wing characteristics. Evolutionary Ecology 23: 473-485.

Fig. 1: Murray, T. "Bog Copper Butterfly on Plant." *The Butterflies of Massachusetts*, 27 June 2004, www.butterfliesofmassachusetts.net/Bog%20Copper.htm.